New Core Crystal Growth Technology will Enable Ground and Space-Based Systems to Exchange More Information Faster

Payoff

With technology transfer from the Air Force Office of Scientific Research, U.S. industry will use the new growth process to create Indium Phosphide (InP) wafers four times the area of the standard two-inch wafer at a much lower cost. Use of the new process will help industry become a leading supplier of InP substrates to developers and manufacturers of Air Force electronic components used in ground- and space-based systems.

Accomplishment

A team of AFOSR-sponsored scientists from the AFRL Sensors Directorate, a consortium of universities, and GT Equipment Technologies Inc. of Nashua, NH developed an innovative, more efficient and less costly process for growing high-quality InP semiconductor crystals. These crystals form the basis for fabricating wafers used in creating optoelectronics and microwave electronics.

Background

InP-based electronic components perform dramatically better than those made from the traditional Gallium Arsenide or Silicon, because InP can operate at higher frequencies. David Bliss, a materials scientist, led the AFRL Sensors Directorate research team that invented the core crystal growth technology. Team members invented and developed two interrelated techniques that advance the current state of the art in commercial InP production. Their techniques improve on the established two-step process where polycrystalline InP raw material was synthesized in one high pressure chamber, then transferred to and remelted in a second furnace for subsequent "pulling" of a new single-crystal ingot from a melt. The first new Air Force-patented technique involves a one-step process that eliminates the costly transfer step as well as possible contamination. Phosphorus is injected into molten indium to convert it to molten InP. Then an InP seed crystal is lowered into the melt to begin growing the new crystal. A crystal ingot then grows from the seed as it is slowly pulled from the melt. In the second patented innovation, the researchers applied a magnetic field to stabilize the melt to grow a flat-topped ingot rather than the industry standard cone-topped ingot. This results in more wafers per ingot, and also a higher yield of useable crystals. To make the technology more efficient and reproducible, the Directorate collaborated with computer-modelers at the State University of New York-Stony Brook's Center for Crystal Growth. This process is being transferred to GT Equipment Technologies Inc., (GTi) under the Small Business Technology Transfer program. GTi will market a next-generation crystal growth system that utilizes the new Air Force technologies.